Using Neural-Taguchi Method and Genetic Algorithm in Optimization of Multi-Response Process Control

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ABSTRACT

In the recently years, Taguchi method has been widely applied in the practical applications for optimizing the process parameters in the manufacturing process. However, the method only takes a single quality attribute into account. In this research, a systematic method is proposed to optimizing the process parameters with multiple quality attributes encountered. The method begins on applying TOPSIS and fuzzy theory techniques to integrate the multiple quality attributes into a single quality index, then a neural network model is designed for establishing the output prediction function; finally, a genetic algorithm is employed to obtain a set of process parameter for satisfying the various quality requirements in the manufacturing process. A practical example is demonstrated to verify the adaptability of the proposed method. The results show that the proposed method performs well.

Keywords : Neural Network ; Taguchi ; Multiple Quality Attributes ; Fuzzy Theory ; Genetic Algorithm

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[摘要] 近年來，田口方法在工業上廣泛的被應用來達成製程最佳化參數設計。但是，田口方法大多僅針對單一品質特性探討，對於多品質特性最佳化問題，並沒有適當的解決方案。而且參數設計僅針對某些實驗水準點上的最佳化，而不是全域的最佳化。若因子間存在著交互作用或是因子與品質特性間屬於非線性關係，參數設計的預測能力就會變差，進而影響實驗結果。　　有鑑於此，本研究使用一系統的方法，應用TOPSIS法與模糊理論整合多個品質特性為單一指標，並利用類神經田口法建構其系統模型，最後使用基因演算法蒐尋出似全域最佳解，以達成最佳化參數設計。

本研究將此一系統方法套用於一實例的製程最佳化參數設計，以期望快速提昇製程能力，並驗証此一方法的有效性。

[英文摘要] In the recently years, Taguchi method has been widely applied in the practical applications for optimizing the process parameters in the manufacturing process. However, the method only takes a single quality attribute into account. In this research, a systematic method is proposed to optimizing the process parameters with multiple quality attributes encountered. The method begins on applying TOPSIS and fuzzy theory techniques to integrate the multiple quality attributes into a single quality index, then a neural network model is designed for establishing the output prediction function; finally, a genetic algorithm is employed to obtain a set of process parameter for satisfying the various quality

requirements in the manufacturing process. A practical example is demonstrated to verify the adaptability of the proposed method. The results show that the proposed method performs well.